DC Link Voltage Monitor
for
Power Electronics

DLM4000

User Manual

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DLM4000 – DC Link Voltage Monitor for Power Electronics

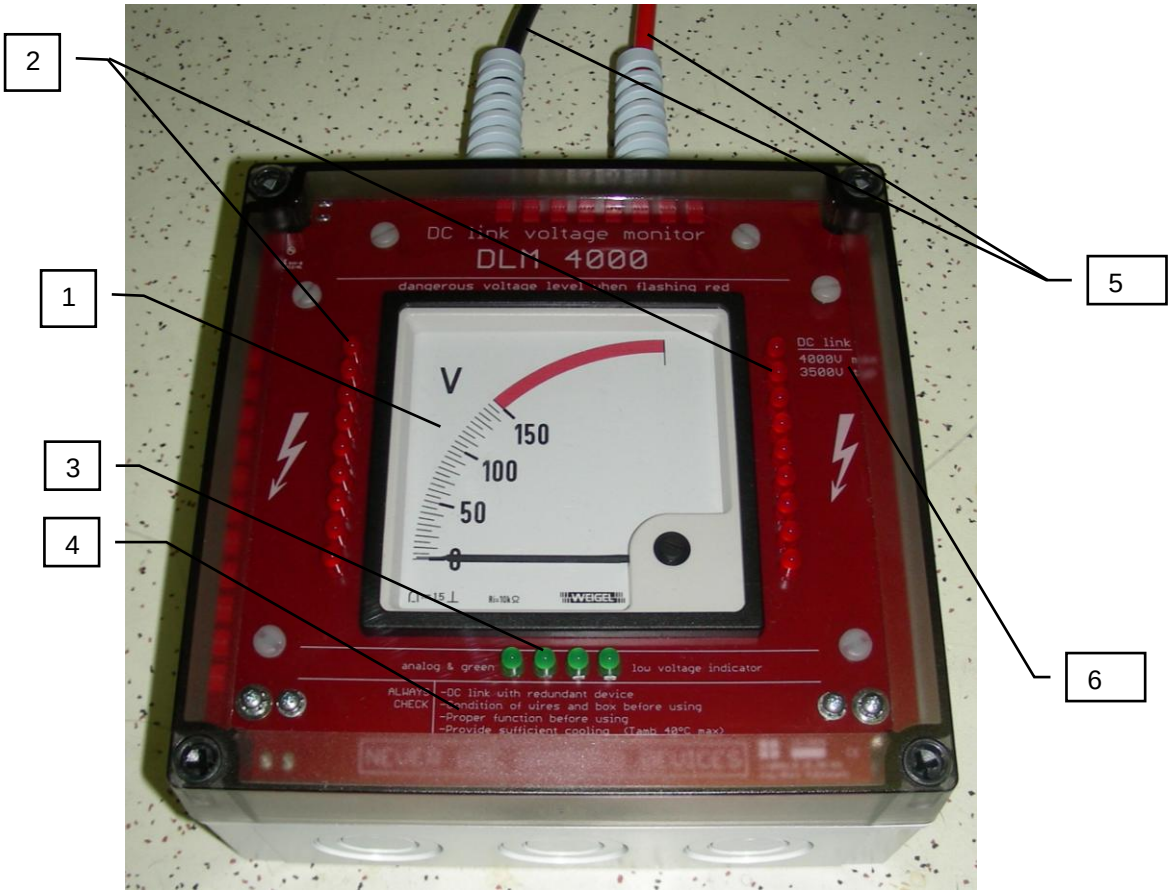

Fig 1: DLM4000 elements

Description of elements

Front side elements and interfaces

1. Analog voltage indicator [tolerant up to 3,5/4kV$_{DC}$, not calibrated]
2. Groups of flashing red LEDs [when DC link voltage is high]
3. Group of green LEDs [illuminating when DC link voltage < 35V]
4. Safety instructions [follow and read carefully]
5. DC link connection cable [firmly attach to DC link voltage]
6. Applicable nominal and max level of DC link voltage

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2 About this document

This document describes how to

- operate
- setup and check function of
- troubleshoot

the DC link Monitor for Power Electronics DLM4000

2.1 How to use this document

Please read this manual carefully, to operate the DLM4000 correctly.

On page 2 and 3 you will find the control elements and interfaces listed in graphical illustration to get an easy link to the description in this manual.

This document targets to the following group of persons:

- Professionals in Power Electronics
- Electronics engineers in the field of IGBT stack development and testing

2.2 Used Symbols and abbreviations

Hint	Hints describe the advantages of certain adjustments and setups and assist You to draw out maximum performance of the unit.
Warning	Warnings: Read and follow these instructions carefully! Warnings shall prevent people from danger and help to avoid damage of the unit or the device under test.

3 Description

The DLM4000 is a DC link monitoring unit with two independent indicators, red flashing LEDs and analog display to confirm if high DC voltage is present. Both indicators share one box and a pair of high voltage cables that must be attached to the DC link before energy is present.
The unit needs no additional power supply, it is operated and supplied from the DC link voltage from $16V_{DC}$ to $3{,}500V_{DC}$ (permanent, 4kV for < 20msec)

3.1 Intended Usage

This unit is designed for industrial use in electronic laboratories and test benches of power electronics, only.
This unit indicates for qualified personal whether dangerous voltages are still present at a DC link, or the DC link is discharged down to a safe level.

Warning
- Never use one instrument only.
- Always check with redundant systems.
- Never rely on one indication when others show danger!

Use this unit in dry and suitable clean areas only and provide sufficient cooling.

3.2 Safety

This section is for your safety. Please read this section carefully before operating the DLM4000.

Qualified personal

The DML4000 may only be started and operated by qualified personal.
Qualified is, who
- has suitable technical training

and
- has got technical instruction from a trained user or the manufacturer concerning the start up and the operation of the DLM4000

and
- has access to this manual at any time.

Reservations of the manufacturer

Maintenance and service may only be fulfilled by qualified service personal with suitable technical training. There are no serviceable components inside the main case of the DLM4000. Always disconnect all energy sources when electrical or mechanical service is applied. Spare parts as well as tools must meet the technical demands of the manufacturer. For preservation of warranty only original replacement parts must be used.
Technical details may change without notice.

3.3 Warning hint, exclusion of liability

This unit monitors dangerous voltages and indicates them visually to laboratory staff.

Warning The DLM4000 may show low or no DC link voltage if
- the box is damaged;
- cables are damaged, or not proper connected to the DC link.
Always use redundant elements to double check DC link voltage.
Always provide sufficient cooling for unit. Never thermally isolate the back side of the box. Ambient temperature must not exceed 40°C

Any liability for damages and injuries caused by the use of this DC link monitor DLM4000 is excluded!

4 Functional description

The DLM4000 is designed as a two channel DC link monitor to check for dangerous voltages at a DC link or other capacitor banks.

The analog display operates as a moving coil instrument and directly indicates voltages from zero up to $150V_{DC}$. If voltage exceeds, the needle reaches a red zone. This zone is linear up to a DC link voltage level of $300V_{DC}$ and tolerates voltages up to $3{,}500V_{DC}$ max. At levels exceeding $300V_{DC}$ the display will remain in maximum red bar position.

Once a voltage $>35V_{DC}$ is applied, the two groups of red LEDs start to flash. They additionally indicate presence of dangerous voltage.

At levels lower than typ. 25V to 30V the red LEDs stop flashing and the green LED bar starts illuminating. They will remain illuminated until DC link voltage levels lower than typically 20V.

Any laboratory staff should always watch at least two redundant connected and operating systems. To check proper discharge and correct function of a DLM4000, analog instrument and red flashing LEDs must be observed. When discharging the DC link the red LEDs must keep flashing while the analog instrument shows DC link voltage decreasing. When low voltage is reached the green LED bar must illuminate until DC link voltage reaches a level lower than typ. 20V. After this the box discontinues electrical operation [power down].

5 Start up and operating the unit

5.1 Check functionality of DLM4000

Always make sure that the unit is functional before attaching to DC link.

Check for

- damage of cables
- damage of box (cracks, loose bushings)
- internal appearance (smoke, burned components, PCBs)

Then

- Apply $50V_{DC}$ from a laboratory power supply and check for flashing red LEDs plus analog voltmeter display.
- Reduce power supply voltage to 20V and check for green LEDs to illuminate while the red LEDs stop flashing. Also observe the change in position of the voltmeter´s needle.

Hint The power dissipation of the unit is mainly transferred to the rear side of the box. Always allow sufficient cooling there. Do not cover the rear side with thermally isolating material. For long term use with high voltages consider attaching the rear side to a cool metal surface using a heat transferring foil or similar devices. The DLM4000 is designed for operation up to 40°C ambient.

5.2 Prepare DLM4000 for operation

Firmly attach DC link cables to the DC link that has to be monitored. Polarity is indicated by red [plus] and black [minus] cables, but the unit will also handle and indicate voltage in reverse polarity without damage. DLM4000 will start operation within much less than a second after applying a voltage of $35V_{DC}$ or higher.

Warning Never attach DLM4000 to a life (charged) DC link. Only connect when DC link is completely discharged.

5.3 Technical data

- Analog moving coil instrument 0-$150V_{DC}$, red bar up to $3{,}500V_{DC}$
- Box operational within a DC voltage range from 0V to 3,500 V permanent
- Box operational within a DC voltage range < 4,000V for <20msec
- Current into unit < 6mA
- Reverse polarity tolerant
- Ambient temperature 40°C max
- Cable is capable to carry 4kV, even if hand held

6 Failure

In case of failure immediately power down the attached DC link and disconnect the DLM4000 after safe discharge. In case of damages please consult us directly.

7 Maintenance, Service, Accessories

7.1 Maintenance

This unit does not need maintenance. It may only be operated in dry, clean areas.
Take care that the unit is kept in a non dusty condition. Dust may cause dysfunction or reduced performance.

Abandonment

1. Discharge the connected DC link
2. Disable all energy sources and disconnect the unit from DC link.

Disassembly

For disassembly proceed as follows:

1. Dismount the unit into single components.
2. Sort these components for material plus disposal criteria and hand it to an official waste management.

Disposal

Hint Respect the specific disposal regulations of Your country.

7.2 Service

Never carry out repair on your own, please contact:

Ing.-Büro M.Billmann	phone:	+49-(0)9104-8235-88
Lerchensteige 10	fax:	+49-(0)9104-8235-89
D-91448 Emskirchen	email:	M.Billmann@t-online.de

7.3 Accessories

The DLM4000 was developed considering a long year experience in power electronics. The goal to create”useful things to make power electronics design and application engineer’s life easier“is main issue.
In correlation to achieve this goal there is available a variety of

- fast DC link dischargers and crowbars
- pulse generators for IGBT characterization
- fiber optical transmitters
- fiber optical receivers (error input, scope trigger, ...)
- adaptors for Semikron SKiiP® interfaces
- coaxial high frequency shunts

For custom specific demands or special options please contact us directly. Quantity and function of accessory parts available on stock is in permanent growth.

8 Annex

This section provides additional documentation that was given by Ing.-Büro M.Billmann or third parties:

8.1 Declaration of Conformity

8.2 Schematic of DLM 4000

8.3 Part location on main PCB

Dipl. Ing. Markus Billmann

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Declaration of Conformity

CE

Manufacturers name and address Ing.-Büro Markus Billmann
Lerchensteige 10
91448 Emskirchen

The Ing. Büro M.Billmann herewith declares conformity of the product

Product name **DC link Monitor**

Type: **DLM4000**

Options: **-**

With applicable regulations

EMV Directive 89/336/EWG amended by 91/263/EWG, 92/31/EWG

Low-Voltage Equipment Directive 73/23/EWG amended by 93/68/EWG

Harmonized standards applied

Safety

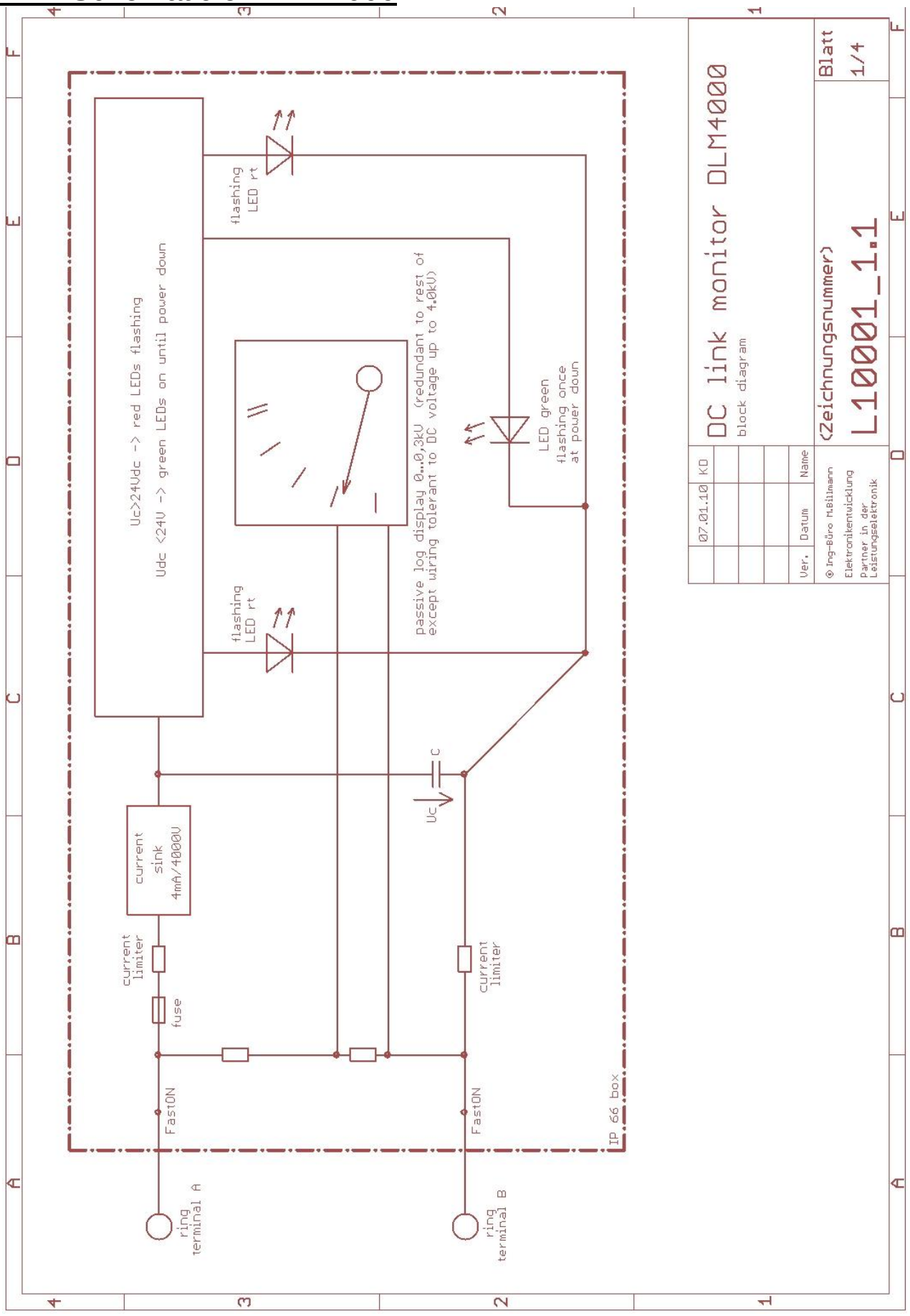
EN61010-1 (VDE 411-1) Safety instructions for electronic laboratory devices

EN60664 (VDE 0110) Isolation
Pollution degree: 1

Technical documentation is fully provided.
Operators manual is attached.

Emskirchen, den 16.06.09 M.Billmann (C E O)

8.2 Schematic of DLM 4000



8.3 Part location on main PCB